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Section	A
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Answer # 1 :

Part A :

Reservoir :

A reservoir is a men-made Lake or large fresh water body of water. Many people think of a reservoir as a lake and might even use the words interchangeable. However the key difference is that reservoir are artificial and lake are naturally.

- Mainly three types of reservoir

1) **Valley damed reservoir**
2) **Bank-side reservoir**
3) **Service reservoir**

In above three types, service reservoir is most economical because it is entirely man-made. His frame construction is easily to

construct as well as no need of any natural water body diversion. It also required small space.

Answer # 1 :

Part B :

There are types of embankments dam. Earth fill embankments and rock fill embankments. Earth fill embankment are the one which consists of 50% or more soil while rods fill embankment consists of 50% or more rock. If we have a hilly area, we should built rock fill embankment because rock fill embankment have more strength than earth fill embankment and in hilly area rods will be easily available which will make our project economical and safe.

Answer # 2 :

Types of Spillways :

Types of Spillways are as follow :

4) **Straight Drop Spillway**
5) **Ogee Spillway**
6) **Shaft Spillway**
7) **Chute Spillway**
8) **Side Channel Spillway**
9) **Siphon Spillway**
10) **Labyrinth Spillway**

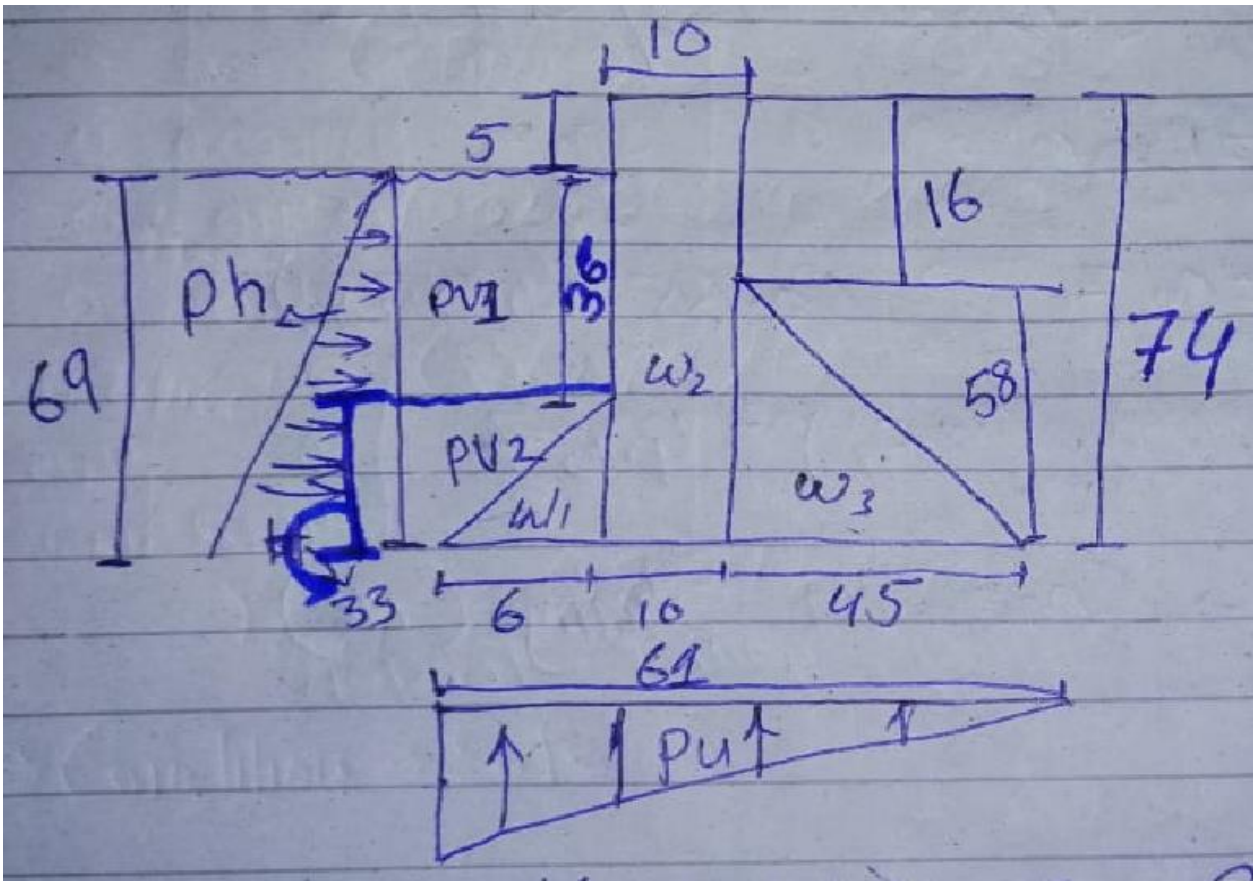
In a condition where freezing point of water is less than -10 degree centigrade in winters the most efficient spillway is chute spillway.

Because chute spillway dispread water from upstream to the downstream through a steeply sloped open channel so that the flow will be very fast chute spillway is also called as trough spillway or open channel spillway.

The slope of chute spillway is designed in such a way that the flow should be always in supercritical condition. Due to this way the chute spillway is full fill the condition of -10 degree centigrade.

Answer # 3 :

Diagram :



Assume unit Weight for Concrete = 24KN/m^3

Assume unit Weight for Water = 10KN/ m^3

Forced and Movement Calculation						
Forces	Force Formula	Fy (KN)	Fx (KN)	Lever Arm	Mr	Mo
W_1	(1/2) x L x W x rd	2376	0	57.00	135432.0	0
W_2	L x W x rd	17760	0	50.00	888000.0	0
W_3	(1/2) x L x W x rd	31320	0	30.00	939600.0	0
Pv1	(1/2) x L x W x rw	990	0	59.00	58410	0
Pv2	L x W x rw	2160	0	58.00	58410	0
Pu	-(1/2) x L x W x rw	-21045	0	40.67	0	855830
Ph	-(1/2) x L x W x rw	0	-23805	23.00	0	547515
	∑	33561	-23805	∑	2146722	1403345

- For Factor of Safety against Tension condition

$$e < \frac{B}{6}$$

$$\frac{B}{6} = 10.17\text{m}$$

Eccentricity of the Resultant force

$$e = \left(\frac{B}{2}\right) - \overline{x}$$

$\overline{x}$ = location of Resultant force from Toe

$\overline{x} = (\sum M_r - \sum M_o) / \sum F_v$

$\overline{x} = 22.15$

So,

e = 8.35m

Condition ⟹ Safe in Tension (OK)

- For Factor of Safety against Stress

Condition ⟹ rheel > 0

$r_{Toe} = (\sum F_v / B) (1 \pm (6e / B))$

$r_{Toe} = 1002.0484 \ KN/m^3$

$r_{heel} = (\sum F_v / B) (1 - (6e / B))$

r_{heel} = 98.31 KN/ m^3

➡ Condition ➡ Safe in Stress (OK)

➢ For Factor of Safety against Overturning

Condition ➡ $(\sum M_r - \sum M_o) > 2$

$r = (\sum M_r - \sum M_o) = 1.53$

Condition ➡ Not Safe in overturning (Not OK)

$(\sum M_r - \sum M_o)$

$\sum M_r = 2146722.0$

$\sum M_o = 1403345$

Condition ➡ Safe (OK)

➢ For Factor of Safety against Sliding

Condition ⟹ $(\iota_w \sum F_r + B_q) / \sum F_H) > 1$

$q = 1400$

$\iota_w = 0.7$ (0.65 to 0.75)

$(\iota_w \sum F_r + B_q) / \sum F_H) = 4.57$

Condition ⟹ Safe in Sliding (OK)